UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Docket Administrator (Room 3J-219)
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EXAMINER
CHANG, EDITH M

ART UNIT	PAPER NUMBER
2637	

DATE MAILED: 03/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	09/938,453	HUANG ET AL.
	Examiner	**Art Unit**	
	Edith M. Chang	2637	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>02 December 2005</u>.
2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) <u>1-42</u> is/are pending in the application.
    4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) <u>1-42</u> is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
    a)☐ All   b)☐ Some * c)☐ None of:
      1.☐ Certified copies of the priority documents have been received.
      2.☐ Certified copies of the priority documents have been received in Application No. _____.
      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1.   A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on December 2, 2005 has been entered.

Response to Arguments/Remarks

2.   Applicant's arguments with respect to claims 1-15, 17-24, 29, 35-39, 41 and 42 have been considered but are moot in view of the new ground(s) of rejection.

Claim Objections

3.   Claim 4 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 1. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim 4 recites the step of determining said joint equalizer solution using channel information for at least one paring of at least one of said transmit antennas and all of said receive antennas being duplicated in lines 5-6 of claim 1.

4.   Claims 3, 6-7 and 18-41 are objected to because of the following informalities:

Claim 3, line 2: "for at least one pairing" should be "for the at least one pairing".

Claim 6, line 2: "equalizer solution" should be "joint equalizer solution" and "the time domain" should be "a time domain".

Claim 7, line 2: "the frequency domain" should be "a frequency domain".

Claim 18, line 7: "said equalizer solution" should be "said joint equalizer solution".

Claim 30, line 23: "the time domain" should be "a time domain".

Claim 31, line 3: "per frequency processor" should be "per frequency bin processor"; line 4: "the frequency domain" should be "a discrete frequency domain"; line 21: "the frequency domain" should be "the discrete frequency domain".

Claim 32, line 18: "in the time domain" should be "in a time domain".

Claim 33, line 17: "the equalization" should be "said MMSE equalizer solution", otherwise, "the equalization" lacks antecedent basis.

Claims 19-29 and 34-41 are dependent on the objected claim 18.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5.   The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the

art to which it pertains, or with which it is most nearly connected, to make and use the same and shall
set forth the best mode contemplated by the inventor of carrying out his invention.

6.   Claims 27 and 28 are rejected under 35 U.S.C. 112, first paragraph, as failing to

comply with the enablement requirement. The claim(s) contains subject matter which

was not described in the specification in such a way as to enable one skilled in the art to

which it pertains, or with which it is most nearly connected, to make and/or use the

invention.

        Claim 27 inheres the limitations, a joint equalizer and a soft bit mapper of the

claim 18 and further comprises a soft bit mapper (not the soft bit mapper recites in the

claim 18) and an error correction decoder that does not described in the disclosures of

FIG.5 of the instant application.

7.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

        The specification shall conclude with one or more claims particularly pointing out and distinctly
        claiming the subject matter which the applicant regards as his invention.

8.   Claims 1-41 are rejected under 35 U.S.C. 112, second paragraph, as being

indefinite for failing to particularly point out and distinctly claim the subject matter which

applicant regards as the invention.

        Claim 1, line 7: "said antennas" does not clearly indicate they are receiver

antennas or transmit antennas? It is ambiguous and indefinite.

        Claims 2-17, line 1: "The invention" lacks antecedent basis.

        Claim 5, line 2: "the discrete frequency domain" lacks antecedent basis.

Claim 12, lines 1-2: "said version of said equalized samples are despread samples" does not clearly indicate said version "are" despread samples or said equalized samples are despread samples.

Claim 18, line 5: "said at least one of said signal sources and said signal detectors" lacks antecedent basis.

Claims 19-41, line 1: "The invention" lacks antecedent basis.

Claim 27, line 3: "said soft bit mapper" does not clearly indicate which soft bit mapper? the one recited in claim 18 line 9 or the one recited in line 2 of claim 27?

Claim 31, lines 1-2: "defined in claim 30 wherein M is the number of signal sources and N is the number of signal detectors" does not clearly indicate what "M" and "N" in claim 30; line 3: "the equalization" lacks antecedent basis.

Claim 31, line 19: "X^H" does not recite in the claim 31 wherein $H(\omega)^H$ is recited; line 21: "the equalized output vector" lacks antecedent basis.

Claim 33, lines 1-2: "defined in claim 32 wherein M is the number of signal sources and N is the number of signal detectors" does not clearly indicate what "M" and "N" in claim 32; lines 10-11: "all said signal detectors" and "all of said signal sources" do not clearly particularly point out what are "all said signal detectors" and "all of said signal sources" respectively, that in claim 18, line 2 recites "a plurality of signal detectors" and lines 2-3 recites "a plurality of signal sources"; line 15: "X^H" does not recited in the claim 33 wherein $H(\omega)^H$ is recited

Claim 34, line 6: "the vector output" lacks antecedent basis.

Claim 36, line 2: "the channels" lacks antecedent basis.

Claim 40, line 7: "X^H" does not recited in the claim 40 wherein $\Gamma(H)^H$ is recited.

Claim Rejections - 35 USC § 102

9.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10.   Claims 1-7, 9-10, 15, 17-19, 23-24, 29, 35-39 and 41-42 are rejected under 35

U.S.C. 102(e) as being anticipated by Walton et al. (US 6,785,341 B2).

Regarding **claims 1, 18 & 42**, in FIG.1, Walton et al. discloses a receiver (154A-

154R DEMOD & 156 RX MIMO Processor) and its method in a multiple-input multiple-

output (MIMO) system (column 3, lines 33-35), said receiver comprising:

A *joint equalizer* (610 Processor in FIG.6A-6C included in 520 Channel MIMO/Data

Processor (FIG.5) of 156 RX MIMO Processor (FIG.1)) *receiving* signals transmitted from

a plurality of signal sources (124A-124T, FIG.1) via a plurality of signal detectors (152A-

152R, FIG.1), *developing/determining* a joint equalizer solution (column 9, line 60-column

10, line 5) using channel information for at least one paring (124A & 152A, FIG.1) of

said signal sources and said detectors and received samples (r, FIG.5, column 11, lines

13-24) of at least two of said signal detectors (152A & 152R FIG.1) and supplying as an

output a signal (Decoded Data Stream, FIG.6A-6C) that includes at least said

equalization solution *applied* to a received signal; and

A *soft bit mapper* (716 Decoder, FIG.7) of 620 RX Data Processor (FIG.6A-6C) for

developing soft bits (column 20, lines 25-34) from the *joint equalizer.*

Regarding **claims 2 & 19**, Walton et al. discloses that the joint equalizer solution

is a joint minimum mean square error (MMSE) solution (FIG.6B, column 9, lines 65-67).

Regarding **claims 3 & 36**, Walton et al. discloses estimating a channel for at

least one paring of a least one of said transmit antennas (or signal resources) and said

receive antennas (or signal detectors).

Regarding **claim 4**, in FIG.1, Walton et al. discloses said joint equalization

solution is determined using channel information for at least one pairing of at least one

of said transmit antennas (124A) and all of said receive antennas (152A-152R).

Regarding **claims 5, 7 & 38**, in FIG.5, Walton et al. discloses determining a joint

equalizer solution being performed at least partly in the discrete frequency domain

(column 15, lines 40-52) for OFDM employed in the data transmission, and applying

said determined equalizer solution being performed in the frequency domain (FFT of all

demodulators 154, column 15, lines 49-53).

Regarding **claims 6 & 37**, in FIG.5, Walton et al. discloses that the determined

equalizer solution is performed in the time domain (column 9, lines 65-67).

Regarding **claims 9-10 & 23-24**, in Table 1 (column 7, lines 20-30), Walton et al.

discloses that at least two of said transmit antennas transmit at different rates (column

5, lines 54-56) and constellations (QPSK or QAM, Table 1).

Regarding **claim 15**, in FIG.1 & FIG.4 (step 412), Walton et al. discloses

performing multiple times, once for each one of said transmit antennas.

In column 11, lines 21-25 state r^1 is the vector of N_R for the first iteration, column 12, lines 1-6 state the successive processing scheme is for recovering one transmitted signal for each iteration, and line 21 states r^{N_r} having N_r iterations wherein N_r is the number of transmit antennas (column 9, lines 45-51).

Regarding **claims 17 & 41**, Walton et al. discloses the joint equalizer solution is

one from a joint least mean square solution (a minimum mean square error technique,

column 9, line 62-column 10, line 4).

Regarding **claim 29**, in FIG.7, Walton et al. discloses an order controller (620 RX

data processor) for determining an order in which signals will be processed (column 20,

lines 12-15).

Regarding **claim 35**, in FIG.1, Walton et al. discloses that the MIMO system is a

wireless system, said signal sources are transmit antennas (124A-124T) and said

detectors are antennas of said receiver (152A-151R).

Regarding **claim 39**, in FIG.5, Walton et al. discloses determining a joint

equalizer solution being performed in the discrete frequency domain (column 15, lines

40-52) for OFDM employed in the data transmission, and applying said determined

equalizer solution being performed in the frequency domain (FFT of all demodulators

154, column 15, lines 49-53), and

Applying said the joint equalizer solution is a joint minimum mean square error

(MMSE) solution (FIG.6B, column 9, lines 65-67).

Claim Rejections - 35 USC § 103

11.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

12.   Claims 8, 11-12 and 22 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Walton et al. (US 6,785,341 B2) in view of Padovani et al. (US

6,574,211 B2).

Regarding **claims 8 & 22**, in FIG.7, Walton et al. discloses 712 Demod Element

to demodulate data (column 20, lines 25-30) in accordance with a demodulation

scheme being complementary to the modulation scheme used for the transmission

channel (column 20, lines 21-25), however, does not specify the well-know dispreading

scheme for the CDMA technique/channel.

Padovani et al. teaches in FIG.2, a despreader (64 Demod, column 9, lines 56-60

'211) to receive samples from Front End 62 (column 9, lines 53-54 '211) to despreade,

decovered and desrambled the received samples (column 9, lines 56-60 '211), then the

demodulated data is provided to Decoder 66 (column 9, lines 60-63 '211).

As Walton et al. incorporating the reference of Padovani et al. (US 6,574,211) of

the CDMA technique (column 32, lines 55-60 '341), at the time of the invention was

made, it would have been obvious to one of ordinary skill in the art to have a

despreader taught by Padovani in the 712 Demod Element (FIG.7 '341) to despread the

data from the receiver Demod (154, as the Front End, column 15, lines 25-28 '341) to

provide the demodulated data to decoder to perform the inverse of signals/samples

processing functions done at a transmitter (column 9, lines 60-63) for the purpose of recovered the transmitted signals/samples over the CDMA channels.

Regarding **claims 11 & 12**, the modified/combined receiver discloses soft mapping (716) a version of said equalized samples from Demod Element 712 of FIG.7 which despreads said equalized samples.

13.   Claims 13-14 and 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walton et al. (US 6,785,341 B2) in view of Yakhnich et al.

Regarding **claims 13-14 & 20-21**, Walton et al. does not specify the well-know structure and algorithm of the soft mapping performed by Decoder 716 (FIG.7 '341), however, Yakhnich et al. teaches the well-know structure and algorithm of the soft mapping of a Decoder in a receiver 50 (FIG.2 '700) that makes the noise equal as the zero means white noise in a posteriori probability's soft mapping (column 12, lines 20-30 '700).

As Walton using the Decoder of a Turbo or a Viterbi technique (column 20, lines 30-35 '341), at the time of the invention was made, it would have been obvious to one of ordinary skill in the art to have the spatial whitening in the posteriori probability metric processing taught by Yakhnich et al. in Walton's Decoder to generate soft decision information for symbols received over a channel (column 1, lines 15-17 '700) to provide soft output information for all symbol possibilities (column 4, lines 35-37 '700).

Allowable Subject Matter

14.   Claims 16, 25-28, 30-34 and 40 are objected to as being dependent upon a

rejected base claim, but would be allowable if rewritten in independent form including all

of the limitations of the base claim and any intervening claims and overcome the 112

rejections and objections set forth in this Office action.

15.   The following is a statement of reasons for the indication of allowable subject

matter:

        The prior art of record fails to teach or suggest, alone or in a combination, among

other things, at least a receiver used in MIMO system for compensating for time

dispersion and its method as a whole, the combination of elements and features, which

includes a buffer-subtractor coupled between a joint equalizer and signal detectors, and

between a space time regenerator and the joint equalizer to subtract a representation of

signals for a currently being processed transmit antenna for each iteration for each one

of transmit antennas.

Conclusion

16.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure.

        Ling et al. (US 2003/0003880 A1) describes a MIMO communication system

utilizing channel state information.

        Monogioudis et al. (US 5,550,810) describes a DS-CDMA MIMO system.

17.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edith M. Chang whose telephone number is 571-272-3041. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay K. Patel can be reached on 571-272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Edith Chang
February 28, 2006

KHAI TRAN
PRIMARY EXAMINER